Experimental Study of the ^{8}B Neutrino Spectrum

S.J. Freedman†, K. E. Rehm‡, B.K. Fujikawa†, G. Gwinner†, B. Harss‡, C. L. Jiang‡, M. Paul§, R. C. Pardo‡, J. P. Schiffer‡, S. Q. Shang†, and P. Vetter†*

The principal source of high energy neutrinos form the Sun is the beta decay of ^{8}B produced by nucleosynthesis deep in the solar interior. The exact shape of the emitted neutrinos from ^{8}B is of current interest because of plans to measure the solar-neutrino energy spectrum directly in the SNO and SuperK detectors. Distortions from the primitive spectrum may provide evidence of "matter enhanced neutrino oscillations" in the solar interior.

The beta decay of ^{8}B is allowed but both the beta and neutrino energy spectrum deviate significantly from an ordinary allowed decay. The decay proceeds primarily to the unbound first excited state of ^{8}Be at 2.9 MeV which decays to two alpha particles. The distortion is due to the broad and complicated energy profile of the final state.

In the past the neutrino spectrum has been calculated from measurements of the delayed alpha spectrum and in one case from constraints imposed from measurements of the beta spectrum[1]. Recently, Bahcall et. al[2] reviewed all the available experimental data attempting to predict the 8B neutrino spectrum and establish the uncertainty with which it is know. It is pointed out in that work that the five existing measurements of the alpha spectrum are in poor agreement. While the basic shape of the spectra are similar there are discrepancies of about 80 keV in the energy scales, making it difficult to asses the overall systematic uncertainty.

We proposed to measure the alpha spectrum directly using the novel technique of implanting 8B in a silicon detector. In previous experiments 8B was implanted in thin metallic foils. We suspect that the discrepancies in the energy scales of the various experiments are due to the difficulties of correcting for energy losses of the alpha particles and uncertainties in the distribution of the 8B in the foil. Our technique will avoid these uncertainties. The experiment makes use of the Enge Spectrograph at ATLAS and a new technique of producing secondary beams with a gas cell target. In this case we use the ^{6}Li(^{3}He,n)^{8}B reaction. The experimental plan was developed this year and the proposal was recently approved by the ATLAS PAC to run this Spring at Argonne.

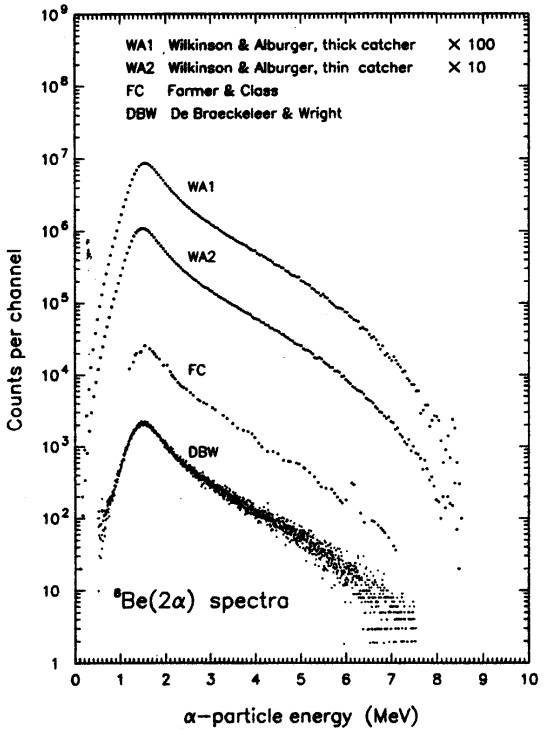

Fig. 1 Delayed alpha particle spectra from previous experiments.

Footnotes and References

†Lawrence Berkeley National Laboratory
*University of California at Berkeley
‡ Argonne National Laboratory
§ Hebrew University , Jerusalem

1. J. Napolitano, S. J. Freedman, and J. Camp, Phys. Rev. C36, 298 (1987)
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